6. ECU

Expansion of memory, expansion of available I/O ports and improvement of high-speed processing capabilities are all required by addition of control system functions. This advanced system requires approximately 80 percent more ROM and approximately 30 percent more I/O signals than are provided in average-scale combined engine and transmission control systems currently mass producted. The I/O signals include input capture and output compare signals. Input capture signals are made necessary by the addition of a clutch revolution speed sensor in the transmission. Output compare signals are made necessary by the addition of linear solenoids used to control hydraulic pressure in the transmission and the adoption of sequential injection. Thus, this greatly increases the load on the microcomputer.

An ECU block diagram of this system functioning with the 8-bit microcomputer in current use is shown in Fig.9. In order to implement this system, it was necessary to use a T5A41 microcomputer for engine control, and another T5A41 for transmission control. T5A41 is the top-of-the-line product in the series. This configuration necessitates the use of serial I/O with direct memory access function for the transmission of data between the two microcomputers. The data communicated in this manner includes information concerning engine speed, intake manifold pressure and torque control-related data. Furthermore, fail-safe logic must be utilized between the two microcomputers, and therefore the two microcomputers operate in accordance with a master-slave relationship. The engine control microcomputer functions as the master, and is provided with a backup IC and a watchdog timer on its power supply IC to monitor abnormal operating conditions. The transmission control microcomputer is the slave, and is monitored by the master; this architecture permits fail-safe operation in the event of malfunctions in either of the two microcomputers.

Fig.10 shows the system under discussion configured with the new 16-bit microcomputer, and a photograph of this ECU is shown in Fig.11. The two T5A41 microcomputers that were used in the system shown in Fig.9 have been replaced the new 16-bit microcomputer.

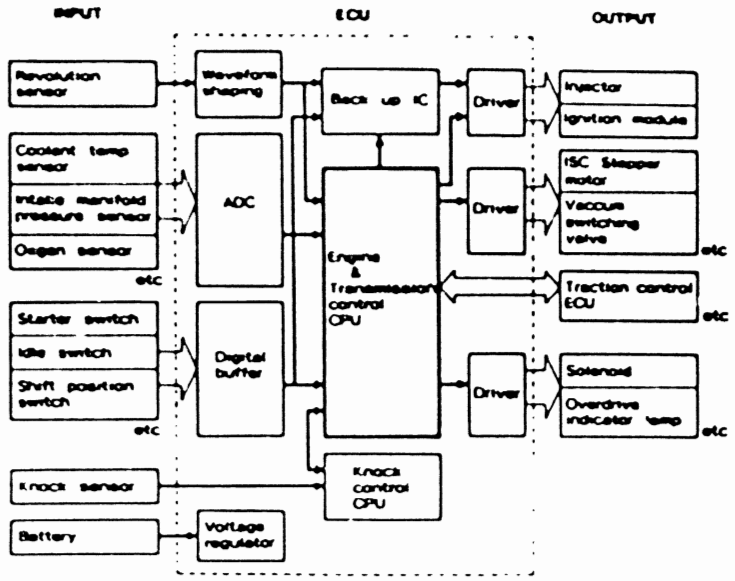

Fig. 10 Block Diagram of ECU with 16bit Microcomputer